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Maintenance Requirement of Dairy Cows 1/

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In many investigations and calculations, the use of a reasonably precise and separate value for the maintenance requirement of cattle is helpful and/or necessary. Several such tables commonly called maintenance requirement standards have been proposed and used during the past 50 years. The data on which each was based is meager and the data or its source are not easily identifiable or obtainable. A search of the literature was made to obtain information on the feeds fed and body weights of cows that had been fed at a maintenance level. Such data was used along with similar data obtained in the present investigation in making estimations concerning the practical maintenance requirements of dairy cows.

The published data of Haecker include intake and body weight on 3 cows for 2 different winter periods each (13). Indefinite data on 20 cows were reported by Hills (14). Data on only 9 of the cows reported by Hills (14) was considered usable in the present report. Good information on the intake and body weight of 8 cows was given by Eckles (6) and 9 cows by Meigs and Grant (17). This is all the data found and the extent to which any of it was ever used in the development of a maintenance requirement standard is not evident. For comparative purposes similar information on dairy bulls (3) was used in calculations in the present report.

Other data from respiration and slaughter trials were obtained and used in some calculations in this report. Transferring these data into a practical maintenance requirement for dairy cows has many limitations, but it was considered useful in making certain comparisons and conclusions.

1/ Paper presented at the Annual Meeting of the American Dairy Science Association, June 19-22, 1960 at Utah State University, Logan, Utah.

The data obtained in the present investigation include dry matter (D.M.) intake, average body weight and body weight change of 25 cows that were fed U.S. #1 alfalfa hay for a preliminary period plus 50 to 729 days and similar data on 8 cows fed a mixture of 78% hay-32% grain (D.M. basis) for 160 to 421 days. The amounts fed were designed to allow minimal body weight changes. All cows were non-lactating and over 4 years of age. Six were pregnant at initiation of the trial and seven were 90 to 180 days pregnant at termination of the trial. Individual data for all these cows is given in table 1.

For this report the data were analyzed using simple non-simultaneous calculations discussed in each section of this report and based on the equation $I = aW^b + kG$. In this equation I = intake; W = average body weight; G = average daily change in body weight and a, b, and k are constants. This is the same as equation #3 of Winchester and Hendricks (23). Some of the data have been subjected to calculations using the exponential equation #5 of Winchester and Hendricks (23) or to multiple regression but these calculations are not complete and will be discussed at a later date.

<u>Estimation of the Nutrients Required for Body Weight Gain</u>: In feeding experiments with cattle it is often necessary or desirable to place a nutrient value on the changes in body weight that occur. Under the conditions of these trials the small body weight changes probably represent a real change in body weight for which the observed intake should be adjusted. Several figures do exist for this purpose. The estimated values of 3.53 and 2.73 lb. total digestible nutrients (T.D.N.) per lb. of weight change are often used (16). The derived value of 2.1 lb. T.D.N. per lb. weight change is also often used (4) while the equally valid derived figure of 1.63 is seldom used (10). Previously we had derived a value of 3.45 lb. alfalfa dry matter (D.M.)(about 1.95 lb. TDN) per lb. of weight change (22). The most accurate value is not known so an investigation using simple mathematical procedures to determine the value to use was attempted.

The method of calculating regression of D.M. intake/1000 lb. body weight on body weight change as used in the previous report (22) was performed on the average data for each cow presented in table 1. A figure of 3.00 lb. alfalfa D.M. per lb. body weight change was obtained. The data from the six values of Haecker (13) and the 9 cows of Meigs and Grant (17) that were fed only alfalfa hay were similarly treated and the average figure of 3.09 lb. D.M. per lb. weight change was obtained. The data on 9 cows of Meigs (17), 9 cows of Hills (14), 8 cows of Eckles (6) and the 8 values for cows at Beltsville (table 1) fed a roughage-grain diet containing approximately 65% T.D.N. (D.M. basis) was combined and similarly treated. A figure of 2.87 lb. D.M. (about 1.86 lb. T.D.N.) per lb. weight change was obtained from these data.

A covariance analysis using gain and total D.M. intake was performed on the data from 17 cows with 2 to 6 multiple observations of 60 to 155 days each. A value of 2.25 lb. alfalfa D.M. per lb. of body weight change was obtained on a within cow basis and the average of the 17 individual values was 2.70.

The use of these simple regression procedures with this data has limitations but they did provide probable values to use for the D.M. equivalent of a lb. of body weight change. Consequently a series of values ranging from 1.25 to 6.21 lb. alfalfa D.M. or its estimated equivalent in TDN per lb. body weight change were used to adjust the observed intake to zero weight change in the data given in table 1 as well as with data from the literature. The adjustment was made on the average data for each individual animal. The relationship between body weight and adjusted intake was calculated for each group using the following equation: Intake = aW^b, converted to logarithms and solving for a and b. The results of this iterative procedure are shown in table 2. The largest correlation for each group of data is underlined and it occurred most frequently when 3.0 or 3.7 lb. alfalfa D.M. (about 1.7 to 2.1 lb. T.D.N.) was used for the nutrient equivalent of a lb. of body weight change.

On the basis of these iterative calculations it was considered justifiable to use the value 3.0 lb. alfalfa D.M. or its determined equivalent 1.7 lb. T.D.N. for the nutritive equivalent of a lb. of body weight change in subsequent calculations made in this report. This is very close to the value of 1.63 lb. T.D.N. calculated by Gaines (10).

<u>The Amount of Feed Necessary to Maintain Body Weight and Its Relation to Body Weight</u>: The average of the data given in table 1 shows that a 1086 lb. cow consumed 13.96 lb. alfalfa hay D.M. with a weight gain of 0.052 lb./day. When adjusted to zero weight gain and calculated to a 1,000 lb. liveweight basis using $W^{1.0}$ to $W^{0.7}$ relationship, the average values were 13.01 to 13.16. Similar values for the cows receiving 32% grain were 10.19 to 10.43. The average weight of the two groups was just more than 1,000 lb. so the requirement per 1,000 lb. was approximately the same using $W^{1.0}$, $W^{0.9}$, or $W^{0.7}$ (table 1). However, when calculating data for the Jersey or the Holstein cows to a 1,000 lb. basis the requirement per thousand lb. varied considerably depending on the relationship between intake and weight that was used (mid-section table 1).

The best relationship for the cows was $W^{0.9}$ for the Holstein cows and $W^{0.7}$ for the Jerseys (table 2). This is also indicated by the smaller coefficients of variation obtained when these fractional powers of body weight were used on the data for the respective breeds (mid-section table 1).

The use of a constant (W^b) in data other than that from which it was calculated is often done but does lead to some inaccuracies (2). This is demonstrated in the data given in table 3 where the constants 0.7 and 0.9 were both used on the average values obtained for each breed. The use of the constant 0.7 for the power of body weight with the data on Holstein cows gave values for 1400 lb. body weight that were below the more correctly calculated value of 16.41 as well as below observed values for Holstein cows of this body weight. The use of the constant 0.9 with the data on Jersey cows gave a value of 10.15 for a 700 lb. cow which was below the more correctly calculated value of 10.55 as well as below the observed values for cows of this body weight.

The cows of the two breeds not only differed in their relationship between body weight and maintenance but the Jersey cows had a higher maintenance requirement than the Holstein cows at any given weight. This was also evident in the earlier data of Ritzman and Benedict (21).

There was no difference in the maintenance requirement of pregnant (0-180 days) and non-pregnant cows with the factor used in this report to adjust intake to zero body weight change. This relationship between body weight and maintenance requirement--the exponent b in the equation aW^{b}--has been discussed by several investigators (2,19,12,15). Those that have examined this subject most extensively in the large animal field have concluded that the maintenance requirement varied linearly ($W^{1.0}$) or had a higher exponent than $W^{0.73}$. Data with rats showed a linear relationship between body size and total intake or metabolism (20).

Several values that have been found for this exponent are presented in table 4 along with the mathematical expression for the maintenance requirement. Axelsson found the exponent to be 0.8 in calculations of the respiration data from Mockern and Copenhagen and advocated the use of $W^{0.8}$ in group data and $W^{1.0}$ in individual data (2). With the most proper calculations Gaines obtained a value for the exponent of 0.93 for American cows and 1.0 for Danish cows (10). Two other authors, lines 4 and 5 table 4, assumed exponents of 0.73 and 0.75 in their calculations (3,10). The rest of the values presented in table 4 were calculated for this report using data from the sources indicated. In the majority of these data the exponent was found to be 0.8 or higher.

The relation between maintenance requirement and body weight is complicated and somewhat variable from group to group. The genetic differences between individuals within any group probably influence this exponent. Some evidence indicated that the efficiency of food utilization for maintenance of all individuals of the same weight or different weights is not the same (22). The data on the exponent indicate that the conclusion of Axelson appears justified: "From one population to another it may vary within wide limits, and therefor scientific work cannot be based on an exponent obtained from a population other than that in question" (2).

The maintenance requirement found for animals in this investigation was approximately 13.00 lb. alfalfa D.M. per 1,000 lb. liveweight. The T.D.N. value of the predominant hay used in this trial was found to be 56.5% and the digestible energy content was 57.5%. Thus the maintenance requirement was 7.35 lb. T.D.N./1000 lb. This is within the ranges of other data given in table 4. Garrett et al. (11) indicated that the lb. T.D.N. for maintenance was equal to 58% and 103% of the therms of metabolizable and net energy, respectively. These factors are similar to others and when applied to the data in table 4 that are expressed in metabolizable energy convert them to 6.25 to 7.25 lb. T.D.N. and for those expressed in net energy to 5.6 to 6.1 lb. T.D.N. per 1,000 lb. live weight.

The values calculated by Brody (4) and Gaines (10) were obtained from production record data by mathematically partitioning intake into that used for milk production, maintenance and gain. The values so obtained of 8.2 and 9.9 lb. T.D.N. per 1,000 lb. live weight are higher than other values obtained by direct observations. Reasons for this are not apparent but may be due to methods of calculation or to a difference between "working" and "idle" maintenance requirements (10). The values for bulls were approximately 8.1 to 8.5 lb. T.D.N. per 1000 lb. live weight which is somewhat above the values found for cows.

The maintenance requirement as given in several standards is presented in the bottom portion of table 4. The majority of these standards are in agreement with the bulk of the observations presented in the upper portion of table 4. However, the Savage-Haecker standard and especially the standard formerly used by the Beltsville breeding herd appear to be exceedingly generous.

Maintenance Requirement During Winter and Summer Seasons: The amount of alfalfa dry matter consumed from the last week in May to the first week in September was compared to that consumed from the last week in November to the first week in March for 15 cows with 21 observations during each season. Similar information on 3 cows fed 30.5% grain and 69.5% alfalfa was also obtained. The data are summarized in table 5.

The average weights during summer and winter seasons were practically identical. The intake was corrected for the small weight changes using two of the factors mentioned in table 2. The net amount of feed consumed with no body weight change was practically the same in summer months as during the winter months when either weight change correction factor was used (table 5). The relationship between body weight and adjusted intake was calculated for both the summer and winter seasons and found to be practically identical using the 21 observations when cows were fed only alfalfa hay. The relationship found from data in summer was alfalfa D.M. for maintenance = $0.3958W^{.507}$ and for winter = $0.3966W^{.51}$. The calculated requirement for a 1,000 lb. cow was 13.13 and 13.25 lb. alfalfa D.M. for summer and winter, respectively. These data indicate that the amount of feed required to maintain constant body weight was the same for summer as for winter seasons under the conditions of these trials.

Maintenance Requirement Before and After Ovariectomy: The intake body weight and its changes for 3 cows fed alfalfa hay before and after removal of the ovaries were measured. These values are tabulated in table 6. Calculations showed that each cow required less feed to maintain the same body weight with no weight change after removal of the ovaries.

Hay:Grain Replacement Values: The replacement equivalents of grain and hay are not definitely established. In order to obtain some information on the replacement equivalents of these two feeds adult, non-pregnant cows were maintained on rations having different hay to grain proportions. Eight

Holstein cows were fed a ration having 1.0:0; 3/4:1/4; 1/2:1/2; and 1/4:3/4 proportion of alfalfa hay to concentrate, respectively, for periods of 120 days in an experiment of a Latin square design. Data on the last 90 days of each period were used. Subsequently 4 of the cows were fed only the concentrate (37% soybean meal, 63% corn) for a period of over 180 days. In another trial 4 Jersey cows were fed alfalfa and concentrate in proportions of 1:0; 2/3:1/3; 1/3:2/3 and 0:1, respectively, for periods of 180 days each. Two cows have not yet completed their final period.

The average adjusted consumption, body weights and replacement equivalents are presented in table 7. The average body weight for the Holstein cows decreased when the proportion of dietary concentrate increased. No correction for these changes were made when the replacement equivalents were calculated. The hay replacement equivalents for 100% grain were calculated from the averages of the animals used on this diet and weight had to be adjusted with the 2 Jersey cows using $W^{.7}$.

These calculations using data on the Holstein animals indicate that one lb. of hay is worth about 55% of the value of one lb. of the concentrate used. This calculated replacement equivalent was reasonably near the same for all treatment comparisons made. Data on the Jersey cows gave a similar replacement value but the value was not as repeatable between all treatment comparisons.

The replacement values obtained from these trials approximate the relationship of these two feeds when expressed on an estimated net energy (ENE) basis. The TDN and the digestible energy content was determined using three of the cows and found to be 56.54% and 57.51%, respectively, for the hay and 82.71% and 84.64% respectively, for the concentrate mixture used in these trials. Thus the hay was worth 68% of the concentrate mixture when compared on the determined TDN or digestible energy basis. The ENE was calculated from the TDN value according to the formula of Moore et al. (18) and on this basis the hay was worth 54.7% of the concentrate mixture.

It appears that the replacement values of a hay and a concentrate for purposes of maintaining body weight in dairy cows is best expressed on an ENE basis rather than on a TDN basis.

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Table 1.--Intake, body weight and its change for cows used in maintenance requirement trial at Beltsville.

Cow no. & breed	Observation period (days)	Average body weight (lb.)	Alfalfa D.M. consumed (lb./day)	Gain (lb./day)	Net D.M. for maintenance	Net D.M. for maintenance per 1000 lb. $W^{1.0}$	$W^{.9}$	$W^{.7}$
183 H	720	1393	15.89	-.133	16.29	11.69	12.09	12.92
187 H	729	1193	13.62	-.051	13.77	11.54	11.75	12.17
188 H	390	1198	13.21	-.087	13.47	11.24	11.45	11.87
191 H	553	1358	15.82	-.071	16.03	11.80	12.17	12.94
192 H	553	1388	15.92	+.020	15.86	11.43	11.81	12.61
196 H	623	1136	13.77	+.091	13.50	11.88	12.04	12.35
197 H	613	1138	14.53	+.040	14.41	12.66	12.83	13.16
291 H	443	1302	14.69	-.010	14.72	11.31	11.61	12.24
293 H	473	1306	15.66	-.011	15.69	12.01	12.34	13.02
817 H	90	1351	16.02	-.261	16.80	12.44	12.47	13.61
2408 H[1]	200	1406	17.20	+.289	16.33	11.61	12.02	12.86
194 H[1]	70	1246	17.88	+.850	15.33	12.30	12.58	13.14
199 H[1]	100	1551	17.98	+.013	17.94	11.57	12.09	13.19
351 J	527	724	10.49	-.014	10.53	14.54	14.08	13.20
645 J	360	765	11.03	-.153	11.49	15.02	14.62	13.86
1013 J	210	888	12.01	-.192	12.59	14.18	14.01	13.68
1017 J	440	755	11.20	-.025	11.28	14.94	14.53	13.73
1053 J	310	784	11.03	-.064	11.22	14.31	13.97	13.30
1057 J	180	910	13.98	+.009	13.95	15.33	15.19	14.90
2643 J	140	1026	15.23	-.151	15.68	15.28	15.32	15.40
2696 J	609	1052	12.68	+.070	12.47	11.85	11.91	12.04
635 J[1]	50	981	13.53	+.560	11.85	12.08	12.06	12.01
645 J[1]	69	784	15.27	+.768	12.97	16.54	16.15	15.38
681 J[1]	100	830	11.06	+.163	10.57	12.73	12.50	12.04
1008 J[1]	50	690	9.40	-.338	10.41	15.09	14.54	13.50
25 H + J	344	1086	13.96	+.052	13.81	13.01	13.05	13.16
13 H	427	1305	15.55	+.052	15.40	11.81	12.10	12.78
					s =	± .44	± .39	± .50
					c.v. =	3.71%	3.24%	3.88%
12 J	254	849	12.24	+.053	12.08	14.32	14.07	13.59
					s =	±1.42	±1.31	±1.20
					c.v. =	9.90%	9.35%	8.83%
(Cows fed 78% hay and 32% grain, D.M. basis)								
817 H	421	1355	11.70	-.190	12.19	-	-	-
817 H	339	1400	11.76	+.103	11.49	-	-	-
291 H	395	1296	12.91	+.061	12.75	-	-	-
293 H	395	1291	12.96	-.030	13.04	-	-	-
1017 J	180	738	9.94	+.352	9.03	-	-	-
1013 J	190	850	10.31	+.169	9.87	-	-	-
1053 J	180	801	9.93	+.287	9.19	-	-	-
1057 J	160	904	10.75	+.115	10.45	-	-	-
8 H + J	283	1079	11.28	+.108	11.00	10.19	10.27	10.43

1/ Pregnant

Table 2.--Regression coefficients (exponent-b) and correlation coefficients when different values were used to adjust observed intake according to body weight changes.

Data Source	No. Animals and breed	A		B		C		D		E		F	
		b1/	r2/	b	r	b	r	b	r	b	r	b	r
Table 1	13 - H	.96	.84	.90	.92	.88	.92	.82	.87	.86	.88	--	
Table 1	12 - J	.51	.48	.59	.67	.62	.71	.59	.70	.67	.72	.70	.72
Table 1	25 - H+J	.60	.85	.74	.91	.60	.91	.59	.92	.60	.91	--	
(13)	6 - ?	.68	.94	.66	.95	.65	.95	--		.63	.93	--	
(17)	9 - J	1.19	.88	1.27	.92	1.30	.93	--		1.33	.93	--	
13,17,table 1 combined	40	.81	.79	.81	.82	.81	.83	--		.81	.83	--	
(17)	9 - J	.84	.78	.83	.81	.89	.80	--		.90	.80	--	
(6)	8 - J	.79	.84	.77	.84	.77	.83	--		.76	.82	--	
(14)	9 - ?	.50	.86	.60	.88	.63	.87	--		.67	.87	--	
Table 1	8 - H+J	.65	.93	.54	.93	.51	.93	--		.46	.93	--	
6,14,17,table 1 combined	34 - H+J	.65	.76	.62	.78	.63	.77	--		.62	.77	--	
(3)	18♂ ?	.81	.87	.83	.93	.84	.95	--		.85	.97	--	
(3)	54♂ ?	.92	.80	.92	.89	.92	.89	--		.92	.86	--	
Factor used for nutrient equivalent of 1 lb. body weight change:													
as alfalfa hay D.M.		6.21 -4.81		3.697		3.00		2.25		2.00		1.25	
as T.D.N.		3.53- 2.73		2.1		1.70		1.28		1.14		.72	

1/ b = regression coefficient or relationship between adjusted intake and body weight.

2/ r = correlation coefficient between adjusted intake and body weight.

Table 3.--Effect of using other than the derived constant (b) for calculating maintenance requirement to a given body weight.

		Maintenance requirement in alfalfa D.M. calculated for stated body weight				
		700 lb.	849 lb.	1000 lb.	1305 lb.	1400 lb.
13 Holstein cows	M.R. = $0.02418W^{0.9}$	8.79	10.46	12.11	15.40	16.41
	= $0.10153W^{0.7}$	9.96	11.40	12.78	15.40	16.18
12 Jersey cows	M.R. = $0.10760W^{0.7}$	10.55	12.08	13.55	16.32	17.14
	= $0.02793W^{0.9}$	10.15	12.08	14.00	17.79	18.95

Table 4.--Maintenance requirement of animals used in this trial and from literature data.

Reference	Type of Animals	No. animals	No. trials	Maintenance Requirement: Mathematical formula	Per 1000 lb.	Units
2	Steers	30	137	$0.04394W^{0.8}$	11.04	Therms metabolizable energy
2	Steers	11	45	$0.03671W^{0.8}$	9.22	" " "
10	Dairy cows	253	253	$0.0161W^{0.93}$	9.93	lb. T.D.N.
4	Dairy cows	243	243	$0.053W^{0.73}$ 1/	8.20 1/	lb. T.D.N.
11	Steers & sheep	103	103	$0.036W^{0.75}$ 1/	6.40 1/	lb. T. D.N.
21	Steers & sheep	9	40	$0.00985W^{1.00}$	10.12	Therms metabolizable energy
5	Dairy cows	4	9	$0.00964W^{0.92}$	5.46	Therms net energy
7	Steers	9	13	$0.04879W^{0.69}$	5.73	Therms net energy
8	Steers	5	14	$0.0739W^{0.72}$	10.32	Therms heat produced
8	both	17	61	$0.03846W^{0.73}$	5.96	Therms net energy
1	Steers	23	23	$0.0072W^{1.08}$	12.51	Therms metabolizable energy
3	Dairy bulls	18	18	$0.03645W^{0.85}$	12.34	lb. D.M. (c. 65.5% T.D.N.)
3	Dairy bulls	18	54	$0.02305W^{0.92}$	13.26	lb. D.M. (c. 64.1% T.D.N.)
6,14,17 Table 1	Dairy cows	32	34	$0.14424W^{0.62}$	10.45	lb. D.M. (c. 65.0% T.D.N.)
13,17 Table 1	Dairy cows	38	40	$0.04769W^{0.81}$	12.84	lb. alfalfa D.M. (56.5% T.D.N.)

STANDARDS (that have been used or proposed)

Hills	=	$6.48W^{1.0}$	6.48	lb. T.D.N.
Savage (Haecker)	=	$8.00W^{1.0}$	8.00	" "
Beltsville breeding herd	=	$0.01424W^{0.926}$	8.56	" "
Morrison	=	$0.01883W^{0.874}$	7.45	" "
Brody	=	$0.04358W^{0.730}$	6.75	" "
Armsby	=	$0.06452W^{0.667}$	6.46	" "
NRC	=	$0.01846W^{0.86}$	7.00	" "
Forbes	=	?	5.97	" "

1/ These two investigators assumed 0.73 and 0.75, all other coefficients were calculated.

Table 5.--Summary of maintenance requirement in summer compared to winter.

Season	No. Cows	No. Obser-vations	Ratios	Body Weight Change (lb./day)	Body weight (average) (lb.)	D.M. Consumed	Corrected for weight change using 3.00 lb.alfalfa	Corrected for weight change using 2.25 D.M./lb. change	
S	15	21	100% Alfalfa	-.123	1133	13.746	14.11	14.02	
W	15	21	100% Alfalfa	-.003	1126	14.023	14.03	14.03	
							+ .08	- .01	diff.
S	3	7	69.5% Alfalfa	-.140	1330	12.873	13.24	13.15	
W	3	7	69.5% Alfalfa	+.137	1331	13.574	13.22	13.31	
							+ .02	- .16	diff.

Table 6.--Alfalfa D.M. consumed, average body weight and its change before and after ovariectomy.

Cow no. and breed	BEFORE					AFTER				
	Days	Weight change	Weight	Alfalfa D.M. Consumed	Alfalfa D.M. Corrected[a/]	Days	Weight change	Weight	Alfalfa D.M. Consumed	Alfalfa D.M. Corrected[a/]
		(lb./day)	(lb.)	(lb./day)	(lb./day)		(lb./day)	(lb.)	(lb./day)	(lb./day)
291 H	443	-.010	1302	14.693	14.72	380	+.007	1336	14.489	14.47
293 H	473	-.011	1306	15.662	15.70	380	-.016	1304	14.655	14.70
2643 J	140	-.151	1026	15.231	15.68	207	-.255	972	13.821	14.59
Average =		-.057	1211	15.195	15.37		-.088	1203	14.321	14.59
Alfalfa D.M. per 1000 lb.				$W^{1.0}$	12.69					12.12
" " " " "				$W^{0.9}$	12.94					12.34
" " " " "				$W^{0.7}$	13.44					12.81

a/ Corrected to zero body weight change using 3.00 lb. D.M. per lb. gain, other correction factors gave similar results.

Table 7.--Summary of hay-grain replacement values for maintenance of dry open adult dairy cows.

Treat-ment	No. cows and breed	Consumption adjusted to zero weight change		Body weight	Value of hay (as percent of that of grain)			
					Compared with treatment			
		hay	grain		(A)	(B)	(C)	(D)
		(lb./day)	(lb./day)	(lb.)				
A	8 H	16.17	0	1285	--	--	--	--
B	8 H	10.21	3.47	1282	.582	--	--	--
C	8 H	5.715	5.825	1247	.557	.524	--	--
D	8 H	2.527	7.693	1233	.564	.550	.586	--
E	4 H	0	9.510	1337	.552	.521	.550	.609
					(A)	(F)	(G)	
A	4 J	12.413	0	829	--	--	--	
F	4 J	6.450	3.220	823	.540	--	--	
G	4 J	2.897	5.856	825	.615	.740	--	
E	2 J	0	6.717	800	.555	.567	.404	